

Preliminary Report
Tropical Storm Frances
08-13 September 1998

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Frances was a tropical storm that brought more than 15 inches of rainfall to portions of east Texas, about ten inches in southern Louisiana, and lesser amounts were spread northward across Oklahoma, Arkansas, Kansas, Missouri, and Iowa.

a. Synoptic History

Frances formed within a broad area of low pressure which first showed signs of organization of its associated convective cloudiness on 4 September. The convection was widespread over the western Caribbean and southern Gulf of Mexico, but there was no well-defined low-level center of circulation. This situation persisted for several days as the system moved slowly west-northwestward and during this time three poorly-defined closely-spaced tropical waves moved into the area, perhaps contributing to the development of this system. By the 8th, the system developed a 1000-mb central surface pressure and considerable organized deep convection over a large area of the western Gulf of Mexico. The best track is listed in Table 1 and plotted in Fig. 1 and begins as a tropical depression at this time at a position about 140 nautical miles east of Brownsville, Texas.

The tropical cyclone formation described above, with its large size, loosely organized convection and lack of a distinct center, is known as a "monsoon depression" in the western North Pacific basin.

The tropical depression drifted southward for about a day. By 1800 UTC on the 10th, wind observations from a data buoy, reconnaissance aircraft, and several oil rigs indicated that Frances had strengthened to a 35-knot tropical storm. It began moving north to northwestward at 10 to 15 knots. The center moved inland across the Texas coast just north of Corpus Christi at 0600 UTC on the 11th. By this time, Frances had strengthened to 55 knots under a large anticyclone aloft, weak vertical shear and SST's near 30 degrees Centigrade.

After moving inland, the center moved in a small cyclonic loop for 12 hours between Corpus Christi and Victoria and then moved northward across eastern Texas as a weakening tropical depression. The best track ends at 1800 UTC on the 13th, when the center was near the Texas/Oklahoma border north of Dallas, but the remnant low pressure and rainfall were tracked northward to Iowa during the next 24 hours.

b. Meteorological statistics

Figs. 2 and 3 show plots of U.S. Air Force reconnaissance aircraft wind and pressure data and satellite Dvorak intensity estimates, as well as the best-track pressure and wind curves. Dvorak estimates were provided by the U.S. Air Force Weather Agency (AFGWC), the Tropical Analysis and Forecast Branch (TAFB) of the NWS Tropical Prediction Center, and the Synoptic Analysis Branch (SAB) of NESDIS.

Table 2(a) lists selected surface observations and Table 2(b) lists additional selected rainfall totals. Tropical storm force wind speeds were observed at several data buoy and oil rig locations in the western Gulf of Mexico. The CMAN station at Sabine Texas reported a maximum 2-minute wind speed of 44 knots; this is the highest sustained surface wind speed in Table 2(a). Tropical storm force sustained winds were observed over land at Galveston and Victoria, Texas and at Jefferson County Airport in Louisiana. Frances was a large storm and the 34-knot wind speed radius extended approximately 300 nautical miles north and east of the center.

Storm surge flooding of up to six to eight feet occurred along the middle and upper Texas coast and up to 5 feet along the Louisiana coast. This flooding persisted for about 48 hours.

Freshwater flooding from rainfall was the most significant weather effect. Frances dropped copious amounts of rain over east Texas and southern Louisiana. The highest total reported in Texas was over 16 inches in Brazoria County and the highest total from Louisiana was over 11 inches. Undoubtedly, even higher amounts are likely to have accumulated in these areas.

c. Casualty and damage statistics

The only known fatality directly attributable to Frances was in Lafourche Parish, Louisiana, where a man was killed when his trailer home was destroyed by a tornado spawned by the tropical storm. Six others were injured by this tornado. An indirect death occurred in the New Orleans area where a woman died in an automobile accident.

Moderate beach erosion occurred along much of the upper Texas and western Louisiana coastlines.

Three Texas counties and four Louisiana parishes have been declared as federal disaster areas, primarily due to the rainfall flooding in the wake of Tropical Storm Frances. These include including Brazoria, Galveston, and Harris Counties and the parishes of Cameron, Jefferson, Lafourche and Terrebonne.

The American Insurance Association reports that a total of 110 million dollars in insured property damage has been claimed in Texas, Louisiana and Mississippi. The Houston Chronicle reported that 256 million dollars in damage was inflicted in Galveston County. The total NHC damage estimate for Frances is 500 million dollars.

D. Forecast and warning critique.

Table 3 lists the various watches and warnings that were issued. Tropical storm warnings were issued along the Gulf of Mexico coast from Tampico, Mexico northward and eastward including all of Texas and Louisiana. The warnings for the central Texas coast were issued at 2100 UTC on the 9th, some 33 hours before landfall and almost 24 hours prior to tropical storm force winds reaching the coast. There were only eight forecasts issued while Frances was a tropical storm and none verified at 48 or 72 hours. This number of cases is too small to make any meaningful conclusions about forecast accuracy.

Table 1. Best track, Tropical Storm Frances, 08-13 September 1998.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed(kt)	Stage
1800	25.5	94.5	1000	30	tropical depression
09/0000	25.3	94.4	1000	30	"
0600	25.0	94.5	999	30	"
1200	24.6	94.7	998	30	"
1800	24.2	95.5	997	35	tropical storm
10/0000	23.5	95.6	995	40	"
0600	24.2	95.0	995	40	"
1200	25.3	95.2	996	45	"
1800	26.6	95.2	996	45	"
11/0000	27.2	95.9	994	55	"
0600	28.2	96.9	990	45	"
1200	28.4	97.6	992	40	"
1800	28.5	97.0	994	35	"
12/0000	29.3	96.9	996	30	tropical depression
0600	30.2	96.8	998	30	"
1200	31.0	96.8	1000	30	"
1800	31.3	96.8	1001	30	"
13/0000	31.5	96.8	1002	25	"
0600	31.7	96.9	1002	20	"
1200	32.0	96.9	1003	20	"
1800	33.0	97.0	1003	20	"
11/0000	27.2	95.9	994	55	maximum wind
11/0600	28.2	96.9	990	45	minimum pressure
11/0600	28.2	96.9	990	45	landfall just north of Corpus Christi, Texas

Table 2(a). Tropical Storm Frances selected surface observations, September 1998.

Location	Press. (mb)	Date/ time (UTC)	Sustained wind (kts) ^a	Peak gust (kts)	Date/ time (UTC) ^b	Storm surge (ft) ^c	Storm tide (ft) ^d	total rain (in)
Louisiana								
Acadiana Regional Arpt	1006.	11/230	23	30	11/1605			7.72
Cameron						5.1		
Jefferson County Arpt	1002.	11/210	33	43	11/1312			8.52
Lake Charles Municipal	1003.	11/210	28	35	11/1929			8.04
Lafayette regional Arpt	1006.	11/210	27	35	11/0034			9.04
Patterson Memorial Arpt	1008.	11/230						
Sabine Pass						4.2		
Salt Point	1007.	11/210	22	33	12/0438			11.3
Texas								
Galveston/Scholes Arpt			37	47	10/2219			9.98
Houston Inter. Arpt			24	31	10/2039			6.79
Houston/Hobby Arpt			32	40	10/1919			9.20
Palacios Municipal Arpt			29	46	10/1915			9.53
Bolivar Roads							6.0	
Eagle Point							5.3	
Jamaica Beach							7.1	
Matagorda Locks							8 ^e	
Morgans Point							7.5	
Pier 21							5.6	
Pleasure Pier							7.1	
Sargeant Swing Bridge							8 ^e	
Alice				33	10/2133			
Bob Hall Pier						4.0		
Corpus Christi	993.9	11/132	31	38	10/1931			
Corpus Christi Naval Air	993.8	11/110	32	42	10/1056			
Cotulla				28	11/0747			
Kingsville Naval Air Stn.	996.3	11/113		32	11/1024			
Rockport	993.2	11/132	31	39	11/1832	4.0		
Victoria			36	41	11/0602	5.0		
Port Oconnor								
CMAN stations								
Port Aransas(PTAT2)	992.5	11/110	35	42	10/1900			
Sabine(SRST2)	1001.	11/120	44	57	11/1210			
Southwest Pass(BURL1)	1008.	09/080	37	51	10/1700			
NOAA buoys								
42001(25.9N 89.7W)	1003.	09/110	35	47	10/0640			
42002(25.9N 93.6W)	997.9	10/140	38	50	11/0550			
42019(27.9N 95.0W)	995.2	10/220	34	43	09/1800			
42020(27.0N 96.5W)	996.2	10/230	31	38	09/2000			
42035(29.2N 94.4W)	998.9	11/130	36	44	11/0100			
42040(26.9N 96.7W)			27	35	10/1600			
Offshore oil platforms								
KE12 (28.1N 92.7W)		(140 ft elev.)		50	09/1601			
KR78 (28.3N 92.0W)		(102 ft elev.)		77	10/1953			
KS58 (28.1N 90.7W)		(120 ft elev.)		70	10/1345			

^a Standard NWS ASOS and C-MAN averaging period is 2 min; buoys are 8 min.

^b Date/time is for sustained wind when both sustained and gust are listed.

^c Storm surge is water height above normal astronomical tide level.

^d Storm tide is water height above NGVD.

^e Estimated.

Table 2(b). Tropical Storm Frances additional selected rainfall totals.

Location	Total rain(in.)		
		Liberty	5.51
		Matagorda County	
		Bay city	10.84
Austin County	4.50	Matagorda Colorado Locks	17.00
Belleville		Palacios	10.57
Sealy	5.79	Montgomery County	
Brazoria County		Montgomery	1.85
Alvin	10.80	Wharton County	
Demi-John community	13.00	Danevang	7.05
Freeport Dow Chemical	7.84	Pierce	0.12
Manvel	9.95	Wharton	6.73
West Columbia	16.20		
Chambers County			
Anahuac	11.47		
Beach City	8.22		
Hankavmer	9.35		
Oak Island	8.20		
Smith Point	11.65		
Wallisville	7.77		
Winnie	11.20		
Colorado County			
Colubus	3.46		
Cordele	6.81		
Fort Bend County			
East Bernard	5.46		
Fulshear	7.20		
Needville	7.18		
Orchard	6.25		
Richmond	6.84		
Rosenberg	9.00		
Simonton	8.00		
Galveston County			
Dickinson	8.30		
League City	9.50		
KGBC radio station	8.47		
Santa Fe	12.40		
Harris County			
Barker Dam	0.41		
Baytown	6.59		
Buffalo Bayou at Katy	0.71		
Buffalo Bayou at W. Belt			
Hockley	14.50		
Denver Harbor	14.75		
Houston	10.60		
Houston Spring Branch	3.10		
Houston 3 mi. sw of	13.00		
La Porte	12.87		
Missouri City	6.49		
Seabrook	14.85		
West Houston	10.75		
Location	Total rain(in.)		
Jackson County			
Edna	6.92		
Ganado	8.54		
Lake Texana	3.35		
Liberty County			
Cleveland	5.23		

Table 3. Watches and warnings issued for Tropical Storm Frances, September 1998.

Date/time(UTC)	Action	Location
08/2100	tropical storm warning	High Island to Brownsville, Texas
09/2100	tropical storm warning	northeastern Mexico from Tampico northward
10/1830	tropical storm warning	High Island, Texas to the mouth of the Pearl River, Mississippi
10/2100	tropical storm warning	Lakes Pontchartrain and Maurepas
11/0900	tropical storm warning discontinued	east of Morgan City Louisiana and south of Baffin Bay, Texas including Mexico
11/2100	tropical storm warning discontinued	south of Port O'Connor, Texas
12/0000	tropical storm warning discontinued	Port O'Connor to Morgan City

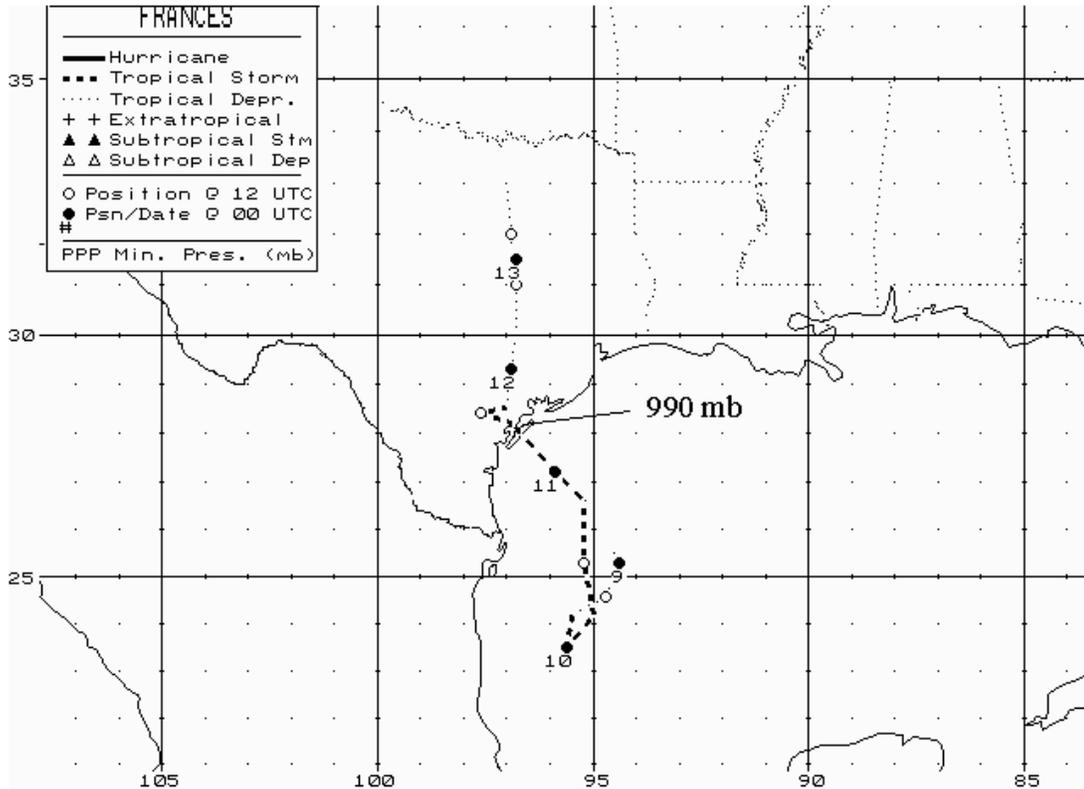


Figure 1. Best track positions for Tropical Storm Frances, 08-13 September 1998.

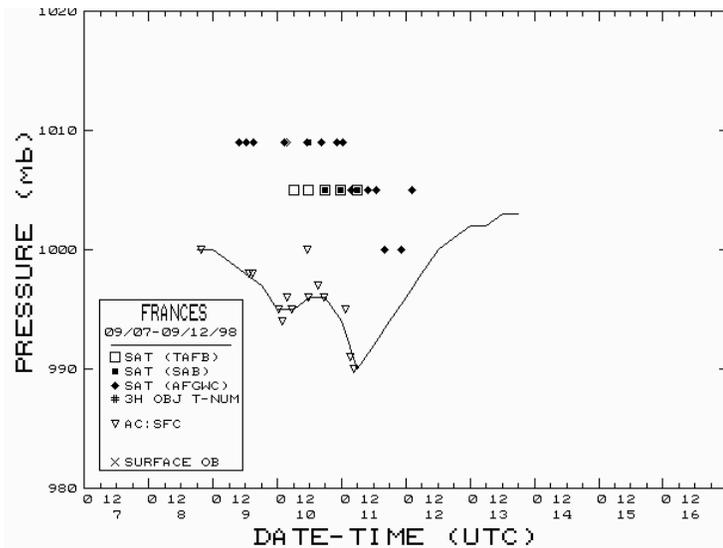


Figure 2. Best track minimum central pressure curve for Tropical Storm Frances.

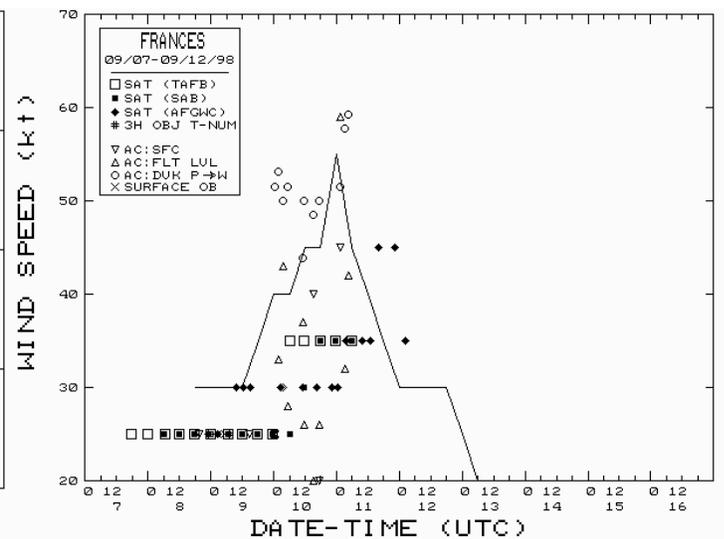


Figure 3. Best track maximum sustained wind speed curve for Tropical Storm Frances.